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(54) Improvements in and relating to washing machines

(57) A washing machine includes legs (1) provided on a lower portion of a washing machine to contact a support surface, thus supporting the washing machine and absorbing a vibration of the washing machine. The washing machine includes a cabinet (2), and legs (1) which support the cabinet on a support surface. Each of the legs includes first and second vibration absorbing parts (25, 21). The first vibration absorbing part (25) contacts, on a bottom surface thereof, with the support surface, and has elasticity to have a higher contracting strain as a weight applied thereto increases. A bottom surface of the second vibration absorbing part (21) is placed higher than the bottom surface of the first vibration absorbing part (25) by a predetermined height, thus contacting with or being spaced apart from the support surface according to the contracting strain of the first vibration absorbing part (25).

FIG. 3A

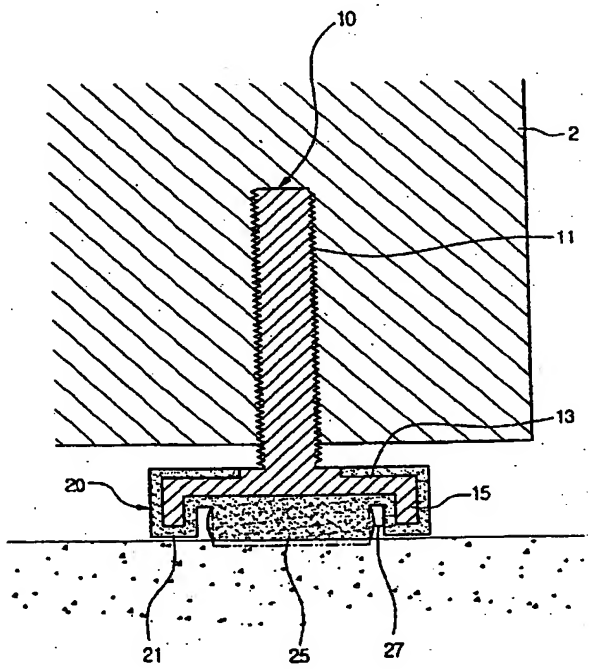

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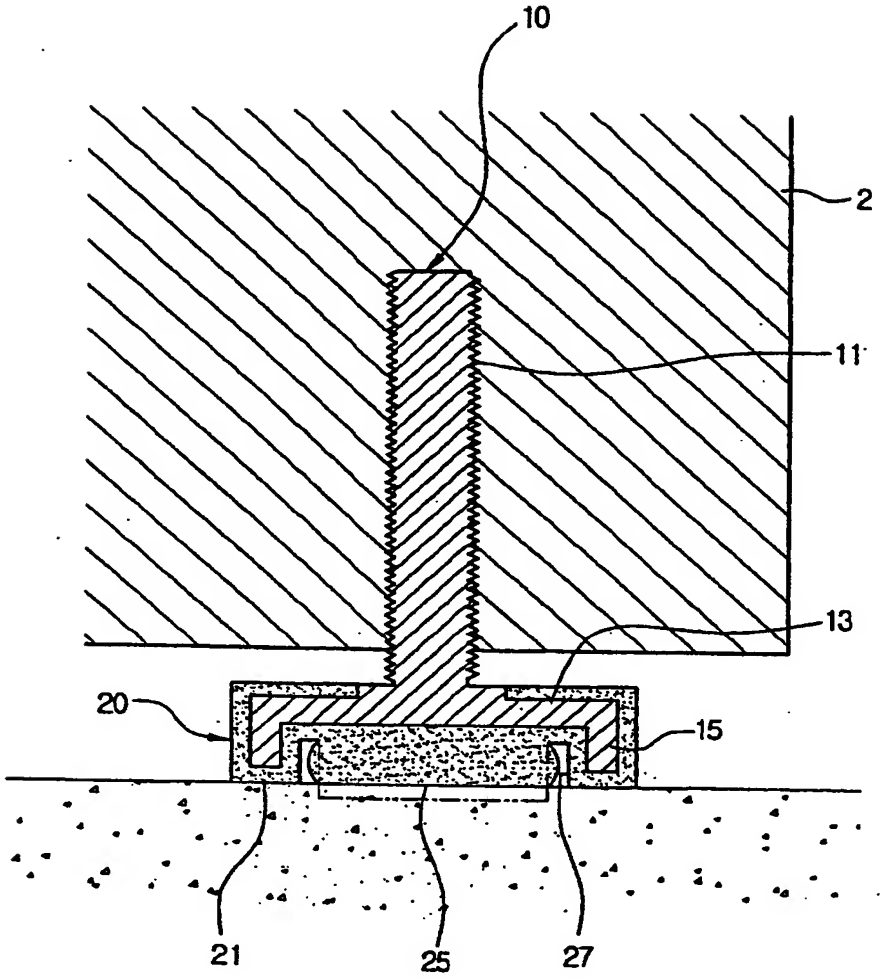
FIG. 3B



Description

[0001] The present invention relates, in general, to washing machines and, also to legs provided on a lower portion of a washing machine to contact a support surface, to support a washing machine and absorb impact when the washing machine vibrates.

[0002] Generally, a machine driven by fossil fuels or electricity, sets in motion internal components thereof using power generated from a drive unit, such as an engine or a motor. In this case, as the machine operates, vibrations of various frequencies are generated, because friction occurs among the internal components of the drive unit when the drive unit rotates.

[0003] A vibration frequency generated during an operation of the machine is called an operation frequency. Furthermore, various machines have respective characteristic frequencies based on physical properties of internal components thereof. There is a strong correlation between the operation frequency and the characteristic frequency and noise generated in the machine. Particularly, when the characteristic frequency is equal to the operation frequency, resonance occurs. When resonance occurs, vibration is remarkably increased. Therefore, it is desirable to prevent the resonance from occurring.

[0004] In conventional washing machines, legs thereof are made of a material having a low characteristic frequency, such as soft rubber, which absorbs a vibration of a high frequency. However, the conventional washing machines have a problem in that a vibration absorbing capacity of the soft rubber is reduced, because there is little difference between a characteristic frequency of the soft rubber and an operation frequency when a frequency of a vibration which is transmitted from a cabinet to the leg, is low. The conventional washing machines have another problem in that plastic deformation of the soft rubber may occur due to the weight of the washing machine, when the soft rubber has been used for a lengthy period of time. Conventional washing machines have a further problem in that the soft rubber may undesirably weaken, because the soft rubber has a low resistance to heat or chemicals.

[0005] Meanwhile, although hard rubber is used, when the frequency of the vibration which is transmitted from the cabinet to the legs is high, there is little difference between a characteristic frequency of the hard rubber and the operation frequency. The vibration absorbing capacity of the hard rubber is thus reduced.

[0006] The above-mentioned problems are more pronounced when the washing machine is placed on an uneven support surface, because loads applied to the legs are not uniform.

[0007] According to the present invention there is provided an apparatus and method as set forth in the appended claims. Preferred features of the invention will be apparent from the dependent claims, and the description which follows.

[0008] The present invention provides washing machine legs arranged to efficiently absorb vibration even when a wide range of operation vibrations are generated.

[0009] The present invention further provides washing machine legs which are resistant to plastical deformation due to a load of the washing machine or from weakening due to heat or chemicals.

[0010] The present invention yet further provides washing machine legs that can be produced using simple manufacturing and assembling processes, therefore increasing productivity.

[0011] Additional aspects and/or advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

[0012] In one aspect of the present invention there is provided a washing machine, including: a cabinet; and at least one leg to support the cabinet on a support surface, the at least one leg comprising: a first vibration absorbing part to contact, on a bottom surface thereof, with the support surface, the first vibration absorbing part having elasticity to have a higher contracting strain as a weight applied thereto increases; and a second vibration absorbing part of which a bottom surface is placed higher than the bottom surface of the first vibration absorbing part by a predetermined height, thus contacting or being spaced apart from the support surface according to the contracting strain of the first vibration absorbing part.

[0013] In another aspect of the present invention there is provided a support leg comprising: a fastening unit fastening the leg to a cabinet; a head formed at an end of said fastening unit; and a vibration absorbing unit surrounding a portion of said head, wherein said absorbing unit comprises first and second vibration absorbing parts separated by grooves.

[0014] Preferably, the first and second vibration absorbing parts may have different characteristic frequencies.

[0015] Preferably, the characteristic frequency of the first vibration absorbing part may be lower than the characteristic frequency of the second vibration absorbing part.

[0016] Preferably, the first vibration absorbing part may comprise soft rubber, and the second vibration absorbing part may comprise hard rubber.

[0017] Preferably, the first and second vibration absorbing parts may be integrated with each other into a single structure.

[0018] Preferably, a groove of a predetermined depth is provided between the first and second vibration absorbing parts, thus minimizing interference between the first and second vibration absorbing parts.

[0019] Preferably, the washing machine further comprises a fastening unit to support the first and second vibration absorbing parts at predetermined portions thereof and fasten the leg to the cabinet.

[0020] Preferably, the fastening unit further comprises a reinforcing part to reinforce strength of one of the first and second vibration absorbing parts.

[0021] Preferably, the leg is constructed so that parts thereof having different characteristic frequencies are integrated with each other into a single structure to contact with the support surface.

[0022] For a better understanding of the invention, and to show how embodiments of the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings in which:

FIG. 1 is a perspective view of a leg included in a washing machine, according to an embodiment of the present invention;

FIG. 2 is a sectional view of the leg of FIG. 1;

FIGS. 3A and 3B are sectional views showing the leg of FIG. 1 mounted to a cabinet of the washing machine.

[0023] Reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. The embodiments are described below to explain the present invention by referring to the figures.

[0024] FIG. 1 is a perspective view of a leg included in a washing machine, according to an embodiment of the present invention. FIG. 2 is a sectional view of the leg of FIG. 1.

[0025] As shown in FIGS. 1 and 2, the washing machine according to an embodiment of the present invention includes the leg 1 which has a fastening unit 10 fastened to a cabinet 2 (see, FIGS. 3A and 3B), and a vibration absorbing unit 20 to absorb a vibration.

[0026] The fastening unit 10 is made of metal, and includes a threaded part 11 and a head part 13 which is provided at an end of the threaded part 11. The threaded part 11 has a cylindrical shape, and is fastened to the cabinet 2. The head part 13 is surrounded by the vibration absorbing unit 20 which will be described later herein. A reinforcing part 15 is provided along an edge of the head part 13 to be downwardly bent. Thus, a central portion of a lower surface of the head part 13 of the fastening unit 10 is formed to be concave, and a step is formed on a central portion of an upper surface of the head part 13.

[0027] The vibration-absorbing unit 20 is made of rubber, and includes first and second vibration absorbing parts 25 and 21, respectively which are integrated with each other into a single structure. The second vibration absorbing part 21 surrounds the reinforcing part 15, while the first vibration absorbing part 25 surrounds the concave central portion of the head part 13. In this case, the second vibration absorbing part 21 may be made of hard rubber, and the first vibration absorbing part 25 may be made of soft rubber. Because the head part 13 is formed to have a concave step on the lower surface thereof, a distance between a bottom surface of the first vibration absorbing part 25 and the lower surface of the head part 13 is longer than a distance between a bottom surface of the second vibration absorbing part 21 and the lower surface of the head part 13. Thus, although the first and second vibration absorbing parts 25 and 21 can conveniently be made of the same rubber, the first vibration absorbing part 25 has higher elasticity than the second vibration absorbing part 21, and thereby the first and second vibration absorbing parts 25 and 21 have different vibration characteristics.

[0028] The reinforcing part 15 is embedded in the second vibration absorbing part 21, thus functioning to reinforce strength of the second vibration absorbing part 21. Conversely, when the first vibration absorbing part 25 is made of the hard rubber and the second vibration absorbing part 21 is made of the soft rubber, the reinforcing part 15 may be constructed to reinforce strength of the first vibration absorbing part 25. Such a construction increases a difference of a vibration characteristic between the soft and hard rubbers.

[0029] A groove 27 is provided along a junction between the first and second vibration absorbing parts 25 and 21. The bottom surface of the first vibration absorbing part 25 is placed lower than the bottom surface of the second vibration absorbing part 21, by a height H, so that the first and second vibration absorbing parts 25 and 21 form a step. Further, the groove 27 is formed along the junction between the first and second vibration absorbing parts 25 and 21, so that the first and second vibration absorbing parts 25 and 21 are spaced apart from each other, thus minimizing interference between the first and second vibration absorbing parts 25 and 21. The first vibration absorbing part 25 is placed at the central portion of the lower surface of the head part 13 and the second vibration absorbing part 21 is placed along the edge of the head part 13, thus effectively preventing the first vibration absorbing part 25 from being damaged due to light, heat, chemicals, etc.

[0030] FIGS. 3A and 3B are sectional views of the leg 1 mounted to the cabinet 2 of the washing machine. As shown in FIG. 3B, when the washing machine is placed on the support surface, the first and second vibration absorbing parts 25 and 21 simultaneously contact the support surface. Although the bottom surface of the first vibration absorbing part 25 is placed lower than the bottom surface of the second vibration absorbing part 21, the first vibration absorbing part 25 is more elastically deformed than the second vibration absorbing part 21, thus making the first and second vibration absorbing parts 25 and 21 simultaneously contact the support surface. Because the first vibration absorbing part 25, having a lower characteristic frequency and the second vibration absorbing part 21, having a higher characteristic frequency, simultaneously contact the support surface,

the first vibration absorbing part 25 absorbs the vibration when a frequency of the vibration transmitted from the cabinet 2 to the legs 1 is high. Further, when the frequency of the vibration transmitted from the cabinet 2 to the legs 1 is low, the second vibration absorbing part 21 absorbs the vibration.

[0031] Meanwhile, when the washing machine operates, the weight of water as well as the weight of the cabinet 2 is applied to the legs 1. In this case, the weight applied to the legs 1 is varied according to washing operations, such as a water supply operation and a water drain operation. Generally, when the washing machine is filled with water, a load applied to a drive unit (not shown) is increased.

[0032] Thus, the frequency of the vibration acting on the legs 1 is reduced. Conversely, when water is completely discharged from the washing machine, the load applied to the drive unit is reduced, the frequency of the vibration acting on the legs 1 is increased. When the weight acting on the legs 1 is large, the frequency of the vibration is reduced. Conversely, when the weight acting on the legs 1 is small, the frequency of the vibration is increased.

[0033] As shown in FIG. 3A, when the weight acting on the legs 1 is small, only the first vibration absorbing part 25 contacts with the support surface, and the second vibration absorbing part 21 is spaced apart from the support surface.

[0034] On the other hand, as shown in FIG. 3B, when the weight acting on the legs 1 is large, the elastic deformation of the first vibration absorbing part 25 is increased, so that the first and second vibration absorbing parts 25 and 21 simultaneously contact with the support surface. Therefore, when the frequency of the vibration action on the legs 1 is high, only the first vibration absorbing part 25 contacts the support surface. On the other hand, when the frequency of the vibration acting on the legs 1 is low, the first and second vibration absorbing parts 25 and 21 simultaneously contact the support surface, thus enhancing vibration absorbing efficiency. Further, when the frequency of the vibration acting on the legs 1 is low, a contracting strain of the vibration absorbing unit 20 is increased. In this case, supposing that the cabinet 2 is supported by only the first vibration absorbing part 25, the first vibration absorbing part 25 may be easily plastically deformed. However, the legs 1 of the washing machine can be constructed so that the first and second vibration absorbing parts 25 and 21 simultaneously contact with the support surface. Thus, even when the frequency is low and the contracting strain of the vibration absorbing unit 20 is increased, the second vibration absorbing part 21 prevents the first vibration absorbing part 25 from being plastically deformed. Further, when the frequency is high, the contracting strain of the vibration absorbing unit 20 is reduced. Thus, although the cabinet 2 is supported by only the first vibration absorbing part 25, the contracting strain of the vibration absorbing unit 20 is not increased so that the first vibration absorbing part 25 is not plastically deformed.

[0035] From the above description, the present invention provides a washing machine having legs contacting a support surface wherein each leg comprises parts having different characteristic frequencies, thus allowing the legs to efficiently absorb a vibration even when a wide range of operation vibration is generated.

[0036] The washing machine of the present invention is constructed so that vibration absorbing parts of the legs having soft and hard parts simultaneously contact the support surface, thus preventing the soft part from being plastically deformed due to a load of the washing machine or from weakening due to heat or chemicals.

[0037] Further, in the washing machine of the present invention, each leg comprises parts having different characteristic frequencies, which are integrated with each other into a single structure, thus simplifying manufacturing and assembling processes, therefore increasing productivity.

[0038] In the washing machine according to the present invention, the soft part is placed at a centre of each of the legs and the hard part is placed along an edge of the leg, thus protecting the soft part against light, heat, and chemicals.

[0039] Further, according to the washing machine of the present invention, each of the legs is constructed so that a fastening unit thereof has a step having different characteristic frequencies, thus allowing the vibration absorbing parts having different characteristic frequencies to respectively contact with the support surface although the vibration absorbing parts are made of a same material.

[0040] In the washing machine of the present invention, the soft and hard parts of the legs form a step, thus allowing the soft part from being elastically deformed to some extent even when the support surface is uneven, therefore allowing the washing machine to be stably placed on the support surface.

[0041] Although a few preferred embodiments have been shown and described, it will be appreciated by those skilled in the art that various changes and modifications might be made without departing from the scope of the invention, as defined in the appended claims.

[0042] Attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

[0043] All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

[0044] Each feature disclosed in this specification (in-

cluding any accompanying claims, abstract and drawings) may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

[0045] The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

Claims

1. A washing machine, including:

   a cabinet (2); and

   at least one leg (1) to support the cabinet (2) on a support surface, the at least one leg (1) comprising:

   a first vibration absorbing (25) part to contact, on a bottom surface thereof, with the support surface, the first vibration absorbing part (25) having elasticity to have a higher contracting strain as a weight applied thereto increases; and

   a second vibration absorbing part (21) of which a bottom surface is placed higher than the bottom surface of the first vibration absorbing part (25) by a predetermined height, thus contacting or being spaced apart from the support surface according to the contracting strain of the first vibration absorbing part (25).

2. The washing machine according to claim 1, wherein the first vibration absorbing part (25) comprises soft rubber, and the second vibration absorbing part (21) comprises hard rubber.

3. The washing machine according to claim 1 or 2, wherein the first and second vibration absorbing parts (25, 21) are integrated with each other into a single structure.

4. The washing machine according to any preceding claim, further comprising a groove (27) of a predetermined depth provided between the first and second vibration absorbing parts (25,21), to minimize interference between the first and second vibration absorbing parts (25, 21).

5. The washing machine according to any preceding claim, further comprising a fastening unit (10) to support the first and second vibration absorbing parts (25, 21) at predetermined portions thereof and fasten the leg (1) to the cabinet (2).

6. The washing machine according to claim 5, wherein the fastening unit (10) further comprises a reinforcing part (15) to reinforce one of the first and second vibration absorbing parts (25, 21).

7. A support leg (1) comprising:

   a fastening unit (10) arrangeable to fasten the leg to a cabinet (2);

   a head (13) formed at an end of said fastening unit (10); and

   a vibration absorbing unit (20) surrounding a portion of said head (13), wherein said vibration absorbing unit (20) comprises first and second vibration absorbing parts (25, 21) separated by at least one groove (27).

8. The support leg (1) according to claim 7, wherein said first vibration absorbing part (25) contacts, on a bottom surface thereof, a support surface, the first vibration absorbing part (25) having high elasticity, and said second vibration absorbing part (21) having a bottom surface placed higher than the bottom surface of the first vibration absorbing part (25) by a predetermined height, thus contacting or being spaced apart from the support surface according to a contracting strain of the first vibration absorbing part (25).

9. The support leg (1) according to claim 7 or 8, wherein the first vibration absorbing part (25) comprises soft rubber, and the second vibration absorbing part (21) comprises hard rubber.

10. The support leg (1) according to claim 7, 8 or 9, wherein the first and second vibration absorbing parts (25, 21) are integrated with each other into a single structure.

11. The support leg (1) according to any one of claims 7 to 10, wherein the groove (27) is of a predetermined depth, to minimize an interference between the first and second vibration absorbing parts (25, 21).

12. The support leg according to any one of claims 7 to 11, wherein the head (13) further comprises a reinforcing part (15) to reinforce one of the first and second vibration absorbing parts (25, 21).

13. The support leg (1) according to any one of claims 7 to 12, wherein the first and second vibration absorbing parts (25, 21) have different characteristic frequencies.

14. The support leg (1) according to claim 13, wherein the characteristic frequency of the first vibration absorbing part (25) is lower than the characteristic frequency of the second vibration absorbing part (21).

FIG. 1

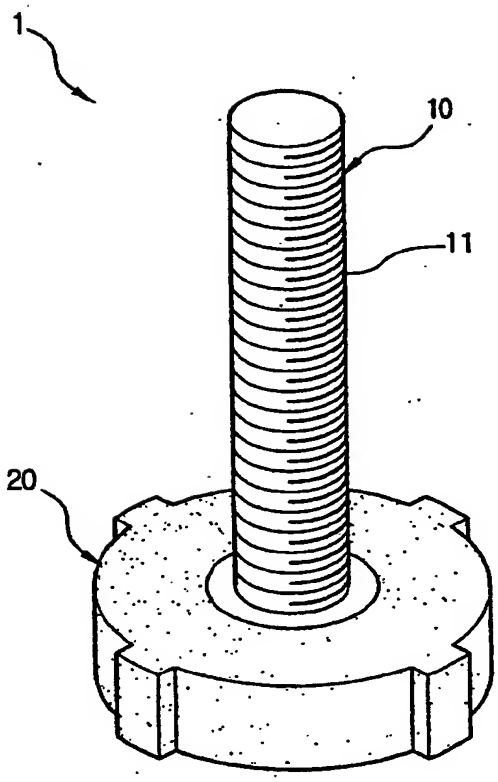


FIG. 2

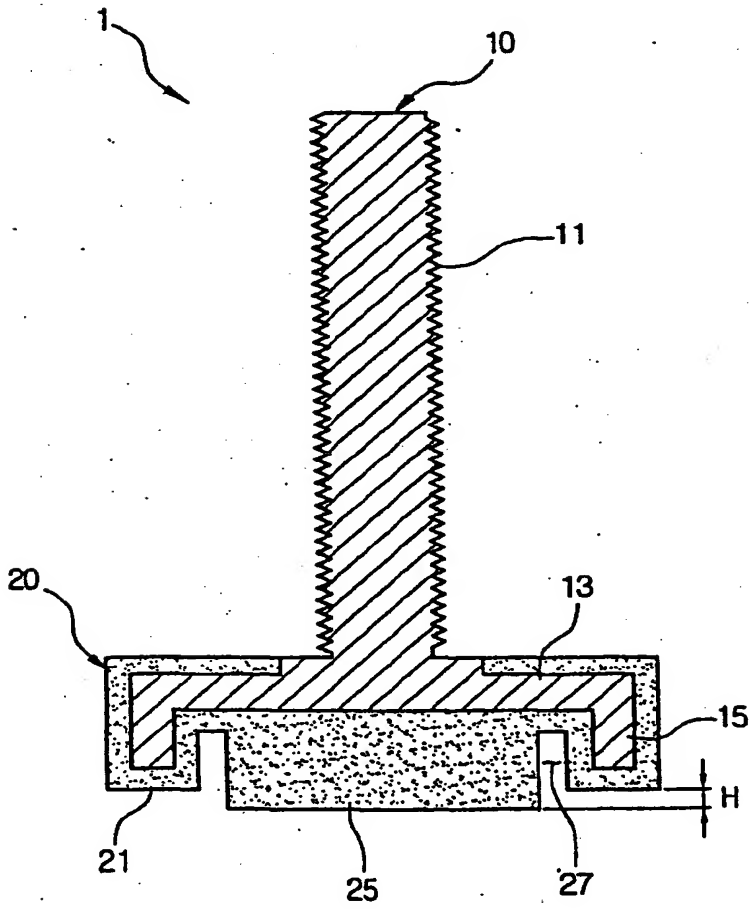


FIG. 3A

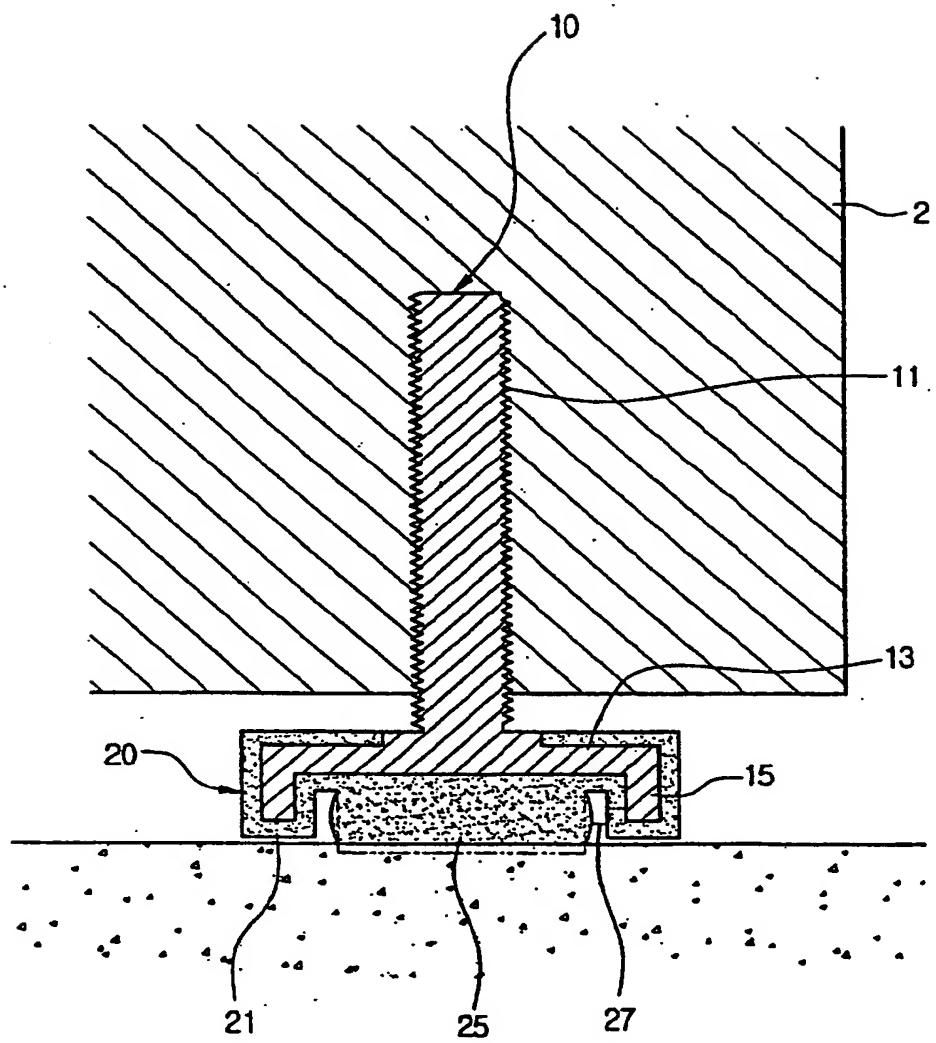
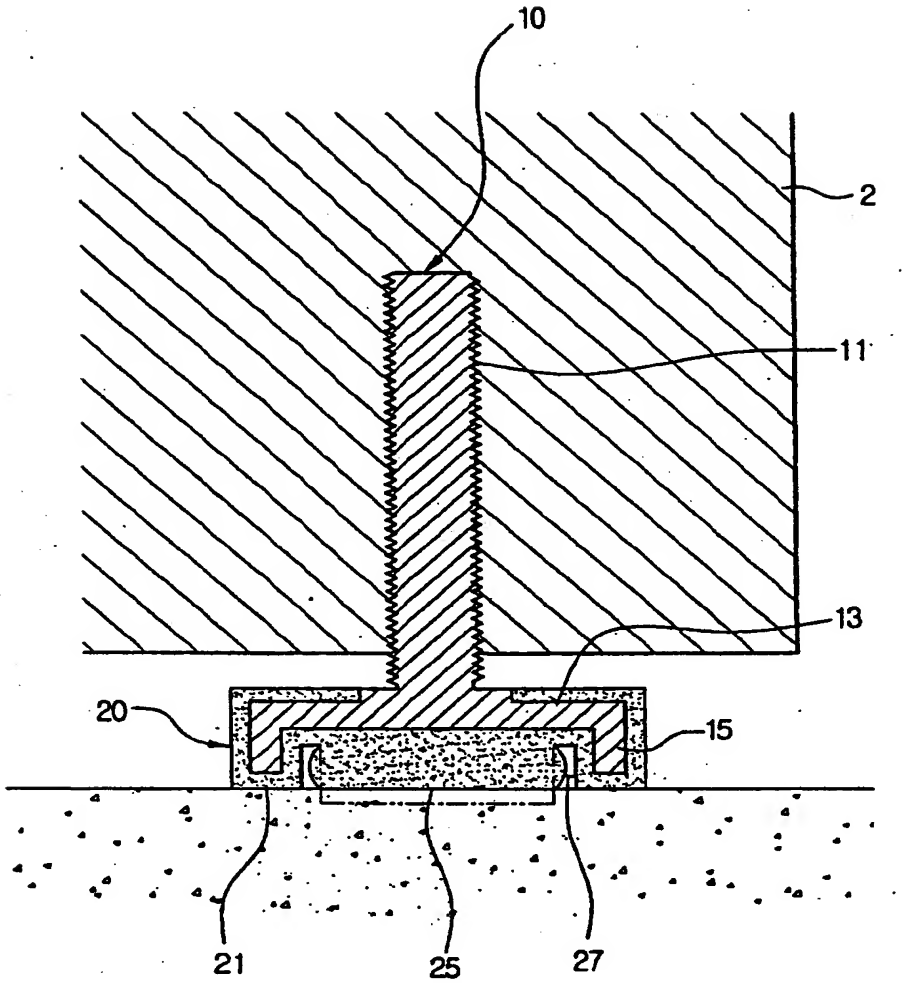


FIG. 3B



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